

September 24, 1982
Lizard Island,
Queensland.

Arrive on island ca 2:45 p.m. A has been here for some time.

He has been watching cuttlefishes. Probably Sepia latimanus. SAN.

There is supposed to be a reef squid here. Tepidoteuthis australis. Called "long-finned flying" (sic!) "squid". A has not been able to find it yet. (Is it coincidental that there is no T₆ here?)

September 26, 1982
Lizard Island.

A took films of 2 ♂ Cuttles yesterday, around noon.

Today we went touring around adjacent islands and lagoons ca. 9:30 a.m. - 1:30 p.m. Habitat is beautiful. But the only cephalopod we saw was a single octopus inshore, on sand. It disappeared into hole. There are many other holes nearby. Could this be a "colony" ???

This evening I walked along the beach, in shallow water, looking for Sepiulids. No luck.

September 27, 1982
Lizard Island.

A rather frustrating day.

We were held up by problems with the motor.

A finally starts tour 12:15 p.m. Beginning South Beach. Nothing. Then we go on to North Reef, where A has seen Cuttles many times before. "Resident" male is still around. Apparently alone now. Not very active. A does some filming. Stops 1:30 p.m. Then I do some swimming in shallow Mermaid Cove ca. 2:10-2:20. Nothing. Finally A dives near Granite Bluff(s). Again nothing.

Cephalopoda

(2)

September 28, 1982

A makes 30 ft dive off Watson Bay in morning. Sees some wife. Nothing else. Then we try to night light in adjacent area ca. 6:30-7:30 pm. Technical difficulties. Nothing fish nor squids.

September 29, 1982
Lizard Island.

Going to try night lighting again. Near Bird Islet. Lots of minnows but no cephalopods.

September 30, 1982
Lizard Island

A films his Cuttle at North Point again. SAN.
No trace of *Sepioteuthis australis*

October 2, 1982
Lizard Island

It was too windy to go out yesterday.
Today the wind was still strong, but A did some filming of his Cuttle.

October 3, 1982
Lizard Island

A more of same Cuttle.

October 4, 1982
Lizard Island

Very windy today, but we go out anyway.
It is too rough to work at North Point. So we go into adjacent Morn-

Cephalopoda, Oct. 5, 1982.

(3)

aid Cove. A finds another Cuttle. Apparently single adult ♂ (territorial? breeding?). Apparently same species seen before. Ca. 60 ft down. Actually not very far from North Point Cuttle (perhaps 100-150 ft away).
Apparently alone. Not very active.

October 5, 1982
Lizard Island.

A looks at Mermaid Cove Cuttle again. Less wind today. But animal still not very active.

①
San Blas,
5 May, 1982

Arrived here yesterday evening ca. 6:00 p.m. Trip very calm. Raining season well begun. Water around Maluneka and Smithsonian Tupper is clear.

Start out rather late this morning. Everything calm. Heat is oppressive. Clouds and rain coming up.

10:50 a.m. Lucho sees 3 small Sepiots by anchor rope. They are gone by the time that we get into water.

11:00 a.m. A starts towing, around Maluneka, over to "Wichiwala", almost to Porvenir, and back. Nothing of real interest. One group of 3 medium Sepiots by deck of Maluneka. Usual place. Group of 10 small Sepiots by "Wichiwala". Nothing more. Rain comes down in buckets. We stop 12:05 p.m.

Go on over to San Blas point. A starts towing 2:20 p.m. First out to tip, then along shore in direction of base of peninsula. Water is murky at base. Clearer inside. No squids. But perhaps some good areas for work tonight.

So we go back with lights 7:30 - 8:30 p.m. Explore a wide area. Bare sand and TG flats. Almost nothing. Only 2 small Sepiots in TG. According to A, they are in Yellow with DM.

It is suggestive that we did not see any more Sepiots. Are most ends further out from shore new?

How did we see any Lolliguncula. Why?

The "Benjamin" is anchored far off shore (because of the Simulium) in deep water. After we get back, ca. 9:45, 2 medium-large Sepiots show up to feed on sardines circling under lights. Both animals are in Ord+. At least one ind. catches at least two fishes.

Jack says that a similar animal showed up earlier, ca. 7:30.

Ceph., May 5, 1982, II

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9:58 pm. Now there are 3 Sepiots feeding on sardines. Probably all 3 medium large. Feeding at different depths. Not coordinated. All 3 in "Bare". Sometimes with White stripe. Sometimes just plain? Why have they assumed this "unusual" coloration tonight? Could it be because the moon is full and particularly bright tonight? Thus encouraging diurnal rather than nocturnal coloration?

There are many peculiar V and contact movements. Apparently just before and after catching fishes.

Sau Blas,
May 6, 1982.

So Okupukkip this morning. Sunny, clear, calm, and hot.

We start out to work 9:40 a.m. A tour around island in usual way. Does some photography. SAN.

I just go to the western end of island, where there are large expanses of shallow sand and TG flats. Swim and walk around, looking for "sepiolids", until 11:50 a.m. No success.

Who is filling the niche of inshore "sepiolids" here. Young Sepiots may be in TG, but they certainly do not occur over sand (There certainly would seem to be plenty of potential food around. Large schools of small sardines are enormously abundant near the shore line here. Ca. 10:00 a.m., most of them seemed to be "asleep" on or near the bottom. This is fine for Gloria's egrets. But why don't cephalopods take advantage of the same opportunities? Would they be too exposed to predators?)

There is something queer about the "Sepiida". Apparently much more abundant and diverse in the Old World than in the New. This may be almost as true of the "sepiolids" as of Sepia itself.

A tour around Okupukkip and adjacent island this afternoon.

Ceph., May 6, 1982, II

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There are some adult Sepiots around, but they don't seem to be doing anything of interest.

We go exploring again at night. Out to outer island, and then almost to barrier reef. Lots of TC, sand, coral, etc. No cephalopods of any sort!

San Blas,
May 7, 1982

Still at Okupukkyu this morning. Sunny, some wind.

A tours all around island 8:25 - 9:25 a.m. Nothing at all.

Then goes for dive along reef where some inds. were seen yesterday. He does find the animals again. They are not very active. At best (and rather dubious-ly) engaged in mild courtship.

We go on to Tiattuppu - Puyattuppu - Panettuppu area.

A starts tour around Puyattuppu, beginning reef point along main land side, then channel. Finds group of approximately 25 Sepiots. Medium to large. 10 ft up in 30 ft of water over sand and coral bottom. The animals are very shy. They are all in Ord-Dark (Medium Dark) with very little or no WS. No courtships.

Then they dash off. According to A, they encounter other inds. in Upward P. Clustered around tall thin (sponge? coelenterate?) Newcomers assume similar P. When I catch up, all visible inds. are in P and semi-Dark.

I get out of water 1:10 p.m. A resumes tour. Then, at 1:53, back at tip of coral reef point (where we started), we find another group of 17+ Sepiots. Some large. Some medium. Intergrading. A lot of courtship (at least). Inds. are over Acropora at edge of reef fall off, 15-20 ft. below surface.

A does lots of filming (4 rolls) until 3:45 p.m.

Ceph., May 7, 1982, II.

(4)

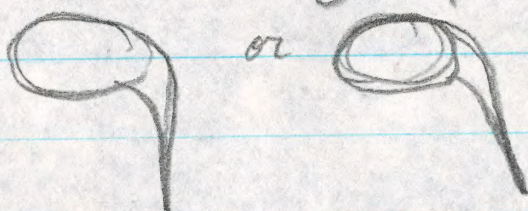
I try not to interfere with the filming. Soon retire to boat. Before leaving, I can follow only one sequence.

A courting party of 1 ♀, 1 near ♂, and 1 far ♂ at end of group. ♀ surfs in extreme Pic, with extreme Walter. ♂ in something like End + (at least with WS, probably not with Y) Far ♂ has RL. RL seems to be permanent or semi-permanent.

Then a third ♂, a second far ♂, joins party. At about the same time, coincidentally (???), A films some 2 performances.

Party of four inds. continues. ♀ Pies and Pies again. All very extreme. Rather surprisingly, this does not seem to discourage her suitors. They press her more and more closely. Near ♂ starts Fluttering Rins forward toward ♀ in apparent copulation attempt. Turns buffy-yellow as he does so. Attempt probably not successful. All members of the party retreat. Come back soon.

NOTE: All or most of the ♀'s Pies were done with arms hanging downward



This probably is typical

A says that "pair", not party, eventually separated from group. And then ♂ began to show Lateral Silver.

Go out at night. Around Panatipo 7:00-8:00 pm. Explore very large areas of TG, and smaller but still extensive areas of almost pure sand. Not a single cephalopod in sight.

COMMENT: We have now done quite a lot of searching in TG at night. And we have found nothing except the 2 small Sepiots near San Blas Point three nights ago. This would suggest (confirm) that small Sepiots leave the flats at night to go out to more open or deeper waters.

In this connection, it may be significant that small sandies also seem to scatter at night.

Ceph., May 7, 1982, III.

(5)

7:00 p.m. Jack has been running the ship light since sunset. Lots of sardines have shown up, but (again) not a single squid. It does look as if populations are low now!

San Blas,
May 8, 1982.

Still at Okupuklep. Heavy rain early in the morning. Gradually clearing up. Getting windy.

We go straight to site where A filmed yesterday. Group is still there. 9:20 a.m. A starts filming again. SAN

I wander about along shore. Mostly T₂. Some sand and coral. See one small blob of ink - that is all.

We both stop 10:45 a.m.

Start again after lunch. A tours Cuniquintuppu. Finds group of large and medium sepia almost immediately. But they are doing nothing. Resumes tour around Cuniquintuppu. Then over to Teatuppu. Then along flat between Teatuppu and Panetuppu. Then along T₂ area of Panetuppu. Then along offshore reef.

We stop 1:25 p.m.

What has gone wrong this year?

Later in the afternoon, we go on to Morpeptuppu. A tours all around island 3:25 - 4:00 p.m. Nothing.

Staying at Morpeptuppu for the night

Make a brief tour of shore facing mainland ca 4:30 p.m. No cephalopods. But lots of small B's. Also wind (thus reducing visibility).

Jack runs the ship lights. Occasional visits by small groups of Telege sp(p). Up to 6 individuals.

(2)
San Blas
May 9, 1982

Still at Morpuputpu. Cloudy. Occasional rain.

A does partial tow along island, all adjacent island, and along farther reef 8:58-9:32 a.m. No squids.

In the afternoon we go to the Rio Sidra area. A tows around both islands, Musatuppu and Urigandi, 3:00-4:05 p.m. Sees nothing except some small blobs of ink on the west side of Urigandi.

Then we go on to mangrove islet (where mixed school of 3 species was seen years ago). A tows 4:13-4:31. Nothing.

We go back to mangrove islet 4:30 p.m. Still nothing.

A few Sepnots come to the ship's lights later on.

San Blas,
May 10, 1982

This morning we moved back to the Perjatuppu area. Weather is gray and windless (after heavy rain at dawn).

A films courting party and associates (same group filmed a few days ago) approximately 9:30 a.m. - 12:20 p.m. and 2:25-4:05 p.m. Apparently with good results.

I spend the time inspecting shallows. On Perjatuppu in the morning. On Cuinguituppu in the afternoon. No cephalopods seen in shallows of either island.

NOTE: Shallows are extremely varied. Sand, TG, "rock" shelves. If Sepioidae and Idiosepiidae are indeed absent from these areas - as does indeed seem to be the case - it is not because suitable physical habitats are not available.

Jack runs the ship's lights. No squids attracted.

San Blas,
May 11, 1982.

Still at Puyatuppu in the morning. Wind has come up and the sun is shining after a fashion.

A filmo usual group 8:10-10:05 a.m.

I wander about shores and shallows

One possible but dubious (very dubious) of a sepiolid-like animal in 3-4 inches of water over sand near beach. Animal immediately takes refuge in adjacent TG. No filming.

I also looked at some fishes. 2 mixed schools (apparently distinct). In 3-4 feet of water over TG and sand with scattered coral heads (plus sponges, etc.) Each school composed largely of dull parrotfishes. Each school also included one spotted Goatfish. The association between the Goatfishes was close (physically), and sustained for at least several minutes. Goatfishes often in middle. Difficult to tell who, if anyone, was leading whom. The second school also included several individuals of 3 or 4 other species. I couldn't identify them.

We go to Matuppu (Lemon Cays) later. A starts tow around island 1:30 p.m. It is still sunny, but sky is turning gradually gray. Finds group of approx 17 inds. far side island 1:54. Most of the inds. are large. Vigorous "courtship". 4 ft down in 10-15 ft of water on steep slope of sand & coral.

A films until 3:15.

NOTES:

This group at Matuppu is much more active, perhaps more advanced in the breeding cycle, than the one filmed at Puyatuppu.

On the other hand, the group at Puyatuppu was interesting because we know that they stayed at (or returned to) the same site day after day.

ADDITION: According to Jamie (?) Wolff, there usually is a group of some 30 (approx.) squids at her study site off Mosquito. But the group

Ceph., May 11, 1982, II.

(8)

is much smaller now. Down to about 10 smallish individuals, Janice says that the reduction occurred about 10 days ago.
Could this be disease ???

May 12, 1982

Leave San Blas before dawn today.

Go first to Isla Grande. Through driving rain. But it is beginning to clear by the time we arrive. A tow ca 12:15 - 1:15 p.m. for 1 small squid, that is all.

Then we go on to Puerto Bello. A tow along east coast outside harbor mouth. Finds 2 groups of large squids. One of 6 inds. The other approximately 12 inds. Below-heavy surf over coral, along rocky shore. No fishing.

Go out to explore part of inner bay with hand lights 7:30 - 8:10 p.m. Lots of sardines and a variety of small organisms. But no squids.

Lots of large sardines at ship lights. But again no squids.

NALUNKA, San Blas

March 10, 1979 - Swim from Smithsonianuppu to Naluneka's dock & back, nothing, it is windy & visibility is not very good either. Night lite from 7 to 9 p.m., nothing.

NIATUPPU

March 11, 1979 - Tow around both islands, nothing. Later on we run into a group of 23 larges & mediums, nothing is happening, some very mild courtship from some very young mediums males, but nothing else.

PANETUPPU

March 12, 1979 - Tow around nursery, and then on to Tiatuppu & Piriatuppu. We spot some 15- large & med. We photographed some action, courtship & lots of patterns. In the afternoon I photographed a group of some 60 juveniles on sand drop off next to Panetuppu caused by the incoming current from the algal reef. Both this drop off & the protected grass flat are perhaps the reason for it being an ideal area for the young. The grass flat offers protection while the current drop off carries sufficient nutrients necessary to maintain the young. There are very small minnows and lots of macroscopic organisms in suspension. At first glance the impression one gets is that the group of young squid is not in formation, each individual is at a different level giving the impression that they are bits of sargassum slowly sinking to the bottom, one could pass them as so much debris. Upon observing them for a while I notice that there is some structure to the group, the large juveniles are high & nearest to the waters surface they diminish in size, the deeper one goes. I closed a diving tank and swim to a depth of 40-45 ft. There I run into a large group of very small young. They each have an overall length of no more than 15 mm. I don't think they are more than 2 weeks old. I photograph them with Barbara's camera both in color & black and white. These little ones produce the same postures as ~~these~~ of their larger counterparts, however, having fewer & larger chromatophores in relation to their body size cannot produce the same color patterns that the larger juveniles produce, but they certainly try.

While I am photographing, a 20"⁺ mackerel rushes a young squid the mackerel attacks and misses, the young squid inks pales & ^{runs} turns up almost vertically towards the surface, then stops after moving only 5-7 ft from where it released the ink, it bars & takes the contort posture. The mackerel swims in circles within the ink blbs, stops for a few seconds & swims slowly away in the direction from where it came. I am not sure but when it swam away it gave me the

impression that at times it did not swim on an even reel. Could his sensing organs have been numbered when it came into contact with the ink blobs?

OKOPUKIP

March 13, 1979. - Tow around both islands (Niakalupir). Find over 35+ squids med to large on usual area in Okopukip. We photograph them, lots of action. Barbara may have photographed a copulation. In the afternoon I go back to Panetuppu & photograph the young some more, then return to Okupukip for more photographs. This group is quite active and at first does not seem to be very cohesive. Sometimes the group breaks up into 3 subgroups & go into different directions. There are quite a few animals in full and active courtship, and also quite a few displays of half silver. This area is full of floating debris, sea grasses as well as man made refuse. I notice that every time the group breaks up, the different subgroups invariably seem to be attracted by bits of floating white plastic sheeting. From far some of these bits of plastic look like a half silver display, could this be the reason that they are swimming towards it? Also, I have been able to relocate ^{the group} it by watching for half silver displays. Could half silver be a display used to attract other squids & thus form a group? I think so. ^{unlike a complete display of silver} Half Silver is or can be also selective since it can be directed at one specific area. (either side of the animal)

We go back to the group & do some more photographing. This time I also use the underwater movie camera. The group is still quite active.

MIATUPPU

March 14, 1979 - Afternoon, we tow but find nothing here.

See Octopus notes p. 11. Discussion of anti-predator strategies. Startle or threat before crypsis. Is this general?

Guam, Nov. 22-26, 1945.

S. lessoniana Guam, Mar 10-14, Mar. 22, 1949

Palau, Malakal Island, Mar. 14 - Mar. 20, 1949

Inhug, Guam.

Squid not in Inhug.

Ord +. WS, PCA, trace of Spade. Extreme Y (silver?)

Downward Curl. Downward V-Curl.

Dark with Downward Curl.

Full Dark with little or no WS.

Belly Bar with Downward Curl.

Egg-laying, p. 3 et seq. ♂ larger than ♀!

Yellow-Ord. WS not conspicuous

Trace of "Accentuated testis" by ♂?

PCA with POA, Waving, White-tips. Drawings p. 5+6.

Bar on back. 3 on mantle, Head bar, 1 bar mid fin, 1 bar

subventral fin. I.E. 6 in total. But not quite the same as in sepioidea.

Bars particularly blotchy.

BL with Yellow Ord by both ♂ and ♀.

Head up posture.

Flash of WS in Yellow Ord as alarm signal.

Gray Ord with WS by medium

WML. Silvery white line along upper front border of mantle.

Fin stripe with retreat.

White fins and trace of Flutter with Gray Ord. Related to Pastel Flutter? (probably not!).

General discussion ecology. p. 7.

✓ Squids begin to show up around March. (Col. Moore).

Over 60 inds. in group. Palau

Dark Without WS

Ink.

✓ Social spacing as in sepioidea.

No strakes ??? Correlated with absence of TG?

Ord +, WS, Y, PCA, Spade (not ludge)

WS dis appears during retreat.

Brigit tawny Golden all over. "Full Gold"

Lateral Silver!

Milky light color in milky light water

PH flicks in Ord. General comment on variability of Ord, p. 17

Groups + sub-groups?

Is Dark relaxed?

Y, BL, and WT in Dark and Ord-Dark.

Full Golden with broad WS. Alternating with Dark. Is Full Golden throat?

Bilateral Silver!

A and B Subgroups. p 19 et seq.

BB - Incident, sketch, 19

Trio. p. 19 et seq.

Cop. attempt P P P P

Does the species lack Z?

Yellowish = Part of sepioidea? p. 21.

Bilateral Double Silver by ♀. Equivalent to Pied, p. 21.

(+ Obvious arm spots!) Partly equivalent to Dark Dorsal Stripe

Unilateral DM a base for in tawny yellow.

WT in feeding.

WS's usually wider toward rear.

Flares. Hostile.

Pale after catching food.

DM both sides of body in yellowish. Intraspecific

BB - band line With WB outside? In semi-Pie (Bilateral silver?)

Again DM with tawny and retreat

White Fins again. Retreating from sandlines in Ord + and WT

Catching copepods. Guam. WT WML

Blush bloom in Gray Ord

BB

Melissa on Balan

13 chromatic, 6 postural, 5 movement

No skin patches or units comparable to Octopus.

Lateral display

Parallel positioning

Fin Beating

Stitchwork fins

Lateral flame

Mid-ventral ridge

Arm spots

Tentacular stripe

Dorsal arm invertebrates

Ring

Downward Curling

Clear = Colorless

Dominance relations (top ♂) more obvious than in sepioids?

Apparent attempts to seize fish from companion

♂ breeding eggs?

DM absent

Lateral Flame instead of Z

Lateral display includes Arm spots, Stitchwork fins, Mid-ventral fins, Lateral flame, Tentacular stripe, and Dorsal arm invertebrates. Certainly aggressive. Usually by dominant ♂ combined with Parallel positioning and Fin beating.

General survey Loligo: spp = plei, pealei, vulgaris, opalescens, forbesi, edulis, bleekeri.

Clear and All dark in all species.

Mid-ventral ridge in preserved specimens pealei, vulgaris, edulis, bleekeri. Lateral flame in preserved specimens vulgaris, forbesi.

Plei

Chromatic

1. Clear (= Colorless) All sizes At night away from lights also calm wds. both day and night. Also egg-brooding by ♂♂.

2. All dark (= Dark) All sizes "Relative stress" (= mild hostility?)

3. Ring (= Bars) 3 or 4 transverse rings around the snout.

4. most common Medium to adult (?) wds

Sometimes with dark head and arms.

"

" Downward Curl

Disruptive Relative stress Perhaps lower intensity than all dark

4. Accentuated testis All dark plus white area (= WS ????)

Schooling, aggression, and courtship Often combined with dark sexual identification on ? = RL ???

5. Shaded testis Both ♂ and ♀. Inacc dark stripe?
??

6. Dorsal stripe (= Dark Dorsal Stripe) Med. to adult ♂♂ and ♀♀
Calm. Feeding. Disruptive?

7. Arm spots. 2 kinds. A dark brown spot base 2nd arm.

B diffuse splotch base 3rd arm. Both usually ♂. Sometimes ♀.

Probably related to PCA

Low intensity stress?

8. Stitchwork fins (= BB). Only ♂♂

Intraspecific aggression After arm spots.

9. Mid-ventral ridge (= Belly stripe) Usually ♂. Sometimes in weak version by ♀♀ Intraspecific aggression Also courtship and schooling. Relative stress often associated with dominance relations

10. Lateral flame Apparently unique. Lateral mottling Only ♂

Also wingless - Mottling

Equivalent but not
analogous with Z!!!

Intraspecific aggressive encounters, including courtship. With parallel
posturing. Often "flashed".

11. Lateral Blush 2 forms

A = Fin stripe Both ♂ and ♀ Becomes incorporated into Lateral
flame as ♂'s get older.

B Diffuse rounded splotch only in mature ♀♀
Also on courted ♀♀ of Lelligemula brevis

12. Tentacular stripe. Dark Only on tentacles Mostly ♂♂, some ♀.
Partly related to some arm stripes. Separate Intraspecific aggression. Sometimes
continuous with mid-ventral edge. Rare. High intensity?

13. Dorsal arm iridophores Only ♂♂. Obviously related to PCA
components With lateral flame. High intensity? Rare

Silver Eyebrows visible in photos
Also Dark Spectacles?

Pha

Postural

1. Bottom sitting Not ritualized Exhaustion. Movement after laying eggs.
2. Two raised arms. Perhaps V. Looks more like DF. Toward conspecifics Very aggressive by small ♂ i.e. pre-attack threat.
3. Four arm upward curling. Toward conspecific or discover. Obviously a more extreme version of 2. above threat.
4. Downward curling. Both ♂♂ and ♀♀.
Intraspecific aggression, interspecific hostility, courtship. ♀♀ before mating (copulation).
5. Downward V curl Same as in 4. Toward discover.
6. Downward curling into mantle. ^{Only ♂} Obviously another version of 4. and 5.
All these downward curls are rather specialized in form. Seen only once.
During prolonged dispute among ♂♂.

Movements

1. Parallel positioning. Not (very) ritualized. In courtship? By both ♂♂ and ♀♀ Courtship and intraspecific aggression.
2. Fin beating (= Flutter?) By ♂♂ only. Only after parallel positioning. Exaggerated form of aggression.
3. Forward rush. Not (very) ritualized By both ♂♂ and ♀♀. Often ending in "rplay". High intensity aggression.

11

4. Chase Not ritualized.

5. Glee Not ritualized.

11/1/1911

Cephalopoda

22 November 1975
Guam.

I arrived on the island on the night of November 19th. So did typhoon June! Impossible to work at all during the first few days.

All the local people claim that at least one squid is common inshore. Chuck had an example identified by Gil Voss. It is Lepidoteuthis lessoniana. Inds. are frequently seen at several sites, in channels leading to electric plants at Piti and Tanguisson, and over or around reef at Cocos Lagoon.

I looked at Piti channel yesterday. Channel is well protected. Relatively calm, although some swell. Water fairly clear. Bottom rock and pebble (some sand). Quite a lot of fish. But certainly no squid. I suppose that the squid withdrew to deeper water (offshore) when typhoon struck.

We went to look at both Piti and Tanguisson twice today. Surprisingly enough, conditions were much worse than yesterday. Huge surge and filthy froth. I didn't bother even to go into water.

Several people have also mentioned seeing real cuttlefish. In Apra Harbor (this record seems quite definite), and ca. Orrote Point (in or near harbor).

23 November 1975
Guam

Visited Piti twice today, ca 8.00 a.m. and 12.45 p.m. Went into water (channel) both times. Heavy swell and lots of froth. Apparently no squid. Also swam in adjacent bay in the morning. In shallows near shore. Sand and rubble bottom. Again.

Cephalopoda - Guam

(2)

no squid.

Visited Tanguisson in late morning. Too rough to go in

24 November 1975
Guam

Go to Piti channel 7:45 am. Sunny, some wind. But still large swell and much froth. Swam back and forth several times. Lots of needle fish at surface. A variety of other fishes. But still no squid. Then swim in adjacent bay. Explore "sinks" not far offshore. Sand, boulder, and broken coral bottom. Perhaps 10 ft deep. Lots of fish, including needle fishes and goat fishes. But again still no squid. (NOTE: this habitat, with no TG and apparently little living coral, would appear, to me, to be unsuitable for Lepidoteuthis — but the local fish are very much what would be expected in a S. habitat. Doubtless the fish know better than I do.)

Go to Tanguisson at mid-day. Still too rough.

Back to Piti ca 2:00 pm. Rougher and murkier than ever. Will the swell never stop?

Try to run lights at night at Piti but bulbs break!

25 November 1975
Guam

Did some exploring today Toward the south of the island.

9:35 am. Arrive at Rizal Beach in Agat Bay. Shallow beach stretching to reef about 100 yds from shore. Weather is sunny, but windy (surf warnings out). I swim along inner side of reef. Shallow. Sand, broken coral, and seaweed bottom. Water very murky,

Cephalopoda - Guam.

(3)

No squid. Chuck swims along outer edge of reef. Also no squid. Comment: this looks as if it might be rather good habitat for squid and/or cuttlefish in better conditions.

11:00 a.m. Coco Lagoon. Shallow bay south of Maricao. Immense "TG" flat. (The local "TG" is Enhalus sp., not Thalassia). Then deeper water. Sand bottom. Then nice small "reef" (coral clumps). Lots and lots of fish. Including goat fishes. Water clear. Strong wind and current. No squid visible at the moment; but the habitat looks perfect.

20 November 1945
Guam

Go back to bay south of Maricao. Work fairly steadily 9:20 a.m. - 12:30 p.m. Generally sunny. Occasional showers. Strong wind. Tide out at first, then comes in strongly. Strong currents and undertow. Cover a very wide area (out to and around two offshore islands on barrier reef) and range of habitats (sand, rocks, coral, TG, in 2-20 ft of water). Lots of fish but no squid.

NOTE: Almost all the fish seen were of medium size. Very few "sandwiches". Is this significant? Does it help to explain absence or scarcity of cephalopods? Have both squid and sandwiches been damaged by weather?

October 23, 1944
Lecas Islands

Some preliminary explorations today. Weather is sunny with little wind.

Ca 9:15 a.m. Canada Island. Swim near shore. Over gravel bottom, then out over boulders, sand, small coral heads. Little or no visible macro-vegetation. Lots of large fish. But apparently no cephalopods. Stop ca. 10:05 a.m.

About an hour later. Barracuda Island. Swim over extensive but shallow coral reef (continuous, rounded or knobly surface - *Porites* sp.?) stretching out from rocky cliffs. Again lots of large fishes. Also many schools (50 to 200 or more individuals) of small fishes that are obovoid, mimicking squids.

Pomacentrid ????



Generally dark gray.
Dark eye. Dark spot base pectoral fin. Yellowish on throat. Tail either shape shown above, or broader with two dark streaks, giving same effect.

Brilliant, shiny, large white "false eyespots" at base of tail (very near top of back). Often swimming in a jerky manner, with rise at end or dip and rise. Thus, the general effect, with eyespot, tail fin, and movements, when a fish was swimming forward,

was that of a squid swimming backward. (It fooled Pat just).
Why should a vulnerable fish mimic a vulnerable squid?
Stop observations abruptly when shark appears.

October 24, 1974
Chiriquí

Made a small dive at San Jose Island (Near Las Ventanas). From beach, ca. 8:30 a.m. Over rubble and rock. Again lots of fishes. But water very murky (rather a strong wind blowing). No cephalopods visible. But I shouldn't be surprised if things like Loliguncula did not appear from time to time.

Obviously Sepiotentris does not occur along the Pacific coast because there is no Turtle Grass (or Turtle Grass - littoral Diadema habitat). But why is the habitat itself lacking?

Cephalopods - Africa

①

August 8, 1976

M Bouri and Joal - south of Dakar.

Centers of fishing industry. The sites where a cuttlefish fishery may be established by the Senegalese gov't and the Centre Océanographique (Chabanne).

We went down to talk to the local people.

Obviously cuttlefishes are more or less abundant - perhaps more so at M Bouri than at Joal.

We saw individuals caught by local fishermen (some in nets from beach, some from boats) Quite large. Apparently Sepia officinalis (Chabanne says that this is the common species).

Most people agree that cuttlefishes begin to be found ca. 100 m. offshore (probably also much farther away). Usually in more or less deep water (50-100 m. ???), usually near bottom.

French scientists at M Bouri (the Dornbath's) say that they saw lots and lots of cuttlefishes high in water column near shore "about 3 months ago" End of dry season and/or beginning of wet season? Mating behavior?

NOTE: Chabanne says that there is at least one other species of Sepia in the region. Smaller and more rounded.

August 17, 1976

M Bouri.

Arrange to go out to "offshore" area where most of the local fishermen that specialize in cuttlefishes (and octopi) prefer to work. It is a relatively shallow bank approximately 1 km from the beach of the ORSTOM Station.

Start off ca 7:45 a.m. Reach bank ca 8:10 a.m.

This is obviously a major fishing area. Lots of pirogues (15-20), jigs, crabs, etc. Also lots of small pirogues (1 to 3

men) hard at work.

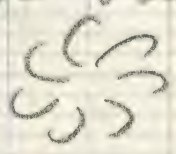
In the course of the morning (until 11:45 a.m.), I do a lot of swimming at 6-8 sites, in waters varying from 3 to 15 m. in depth. Without seeing a damn thing!!!

This is obviously because water is very opaque. Full of sand. Visibility at surface is no more than 1 1/2 - 2 ft. It is a little better around 1 ft down (as far as I can dive in the circumstances), but not much.

It is also obvious, nevertheless, that the upper surface of the waters here is remarkably impoverished. It is not only that I do not see any cephalopods. It is also that I don't see any sardines, copepods, floating weeds, or anything else. In correlation, there are very few birds around. Only an occasional pelican (P. rufescens) floating on water or tern (Sterna s.s. and "Thalasseus") flying by.

The bottom (invisible) fauna, by contrast, must be rich. The fishermen are catching a variety of fish plus cuttlefishes and octopi.

As far as I can tell, all the cuttlefishes are Sepia officinalis. And all are large and apparently adult. The octopi are also fairly large. Perhaps all Octopus vulgaris??

Ratio of Sepia to Octopus caught is approximately 3 to 2. Method of fishing is simple. Pieces of fish used as bait. Placed on circular clusters of hooks  on line. Line jigged constantly. Bait apparently usually cuttlefishes and octopi in much the same way(s). Arms (not tentacles in case of S.?) unjacked on hooks. Then animal is gently, still jigging, brought to surface and gaffed.

Color pattern of S. being brought to surface is moderately striped. Presumably "Ord" of the species. As in many published photos. Turns darker (stripes still visible) when the animals are gaffed.

The cuttlefishes release enormous amounts of ink when gaffed. The octopi do not (perhaps they do not release any at all).

Sepia ink also seems to be rather more "liquid" than that of Sepioteuthis. It may really be more of a "cloud" than a decoy.

One very large cuttlefish was seized by a second, slightly smaller, individual as it was being jugged to the surface. From the published accounts (Boycott? Young?), I would suppose that this was an example of a ♂ seizing a (supposed) ♀. If so, the animals may be in reproductive condition now. If so, the masses of inds. seen near the surface at other times of the year may be "die-offs". (This is confirmed by a local fisherman, Seik, who talked to O. Seik also implied that there may be 3 or 4 die-offs a year. He suggested that the next should be in September-October.)

McBown
Jan. 30, 1944

We have been back here now for almost 2 weeks. Mostly working with birds. Weather is cold and windy (I suppose the "Harmattan"). The water in front of the ORSTOM station still is cold, rough, and murky.

I have, however, been exploring various possibilities.

I have talked with Marget Cat (FAN). He says that there are 3 more or less common species of Sepia along this coast. S. bertheloti inshore; S. orbigera rather far offshore in deeper waters; and S. officinalis, intermediate and also overlapping both the other species.

S. bertheloti is distinguished from officinalis by a narrower brow (doubletters among other things).

M thinks that the breeding season of the local Sepia is May-June. He also tells me that Fricen recently caught lots of Sepioida and small squids (Loliginella sp.) at l'embouchure de La Forne. With lights and net at night. This morning went to look at area. 9:15-11:30 a.m. Tide going out. Windy. Cold. Water murky. Lots of sand in air (Harmattan). Area is rather diverse. Lots of small lagoons and channels. All more or less salt (or salty). Mostly sand bottom. A little mud. A little rock. Some mangrove (inner edge). As a whole, it might be ex-

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collect for certain kinds of cephalopods. But I did not see any myself this morning.

CORRECTION - January 31, 1974. I talked with Freon this morning. Actually, he caught his Sepioida and Loliginula off the mouth of the Senougal. In water 12 m deep, some time ago. Probably in October. Apparently the 2 species were together.

February 9,
1974

Going out on the boat of the Centre Océanographique. Leave Dakar 6:15 p.m. Go to Cap Rouge. About half way to M' Bour. Put out lights ca 8:00 - 8:15 p.m. It is cold. But very rough. Nothing (in the way of cephalopods) shows up immediately. Later on. Some Sardinellas, polychaetes, the occasional eel or half-beak. No great circles.

NOTE: Bottom is 9 m. here.

Run another light. Then pull up nets 10:15. A few fish.

Second station, half way back to Dakar, starts 11:40 p.m.

Lots of polychaetes, small halfbeaks, immediately.

This is off Rufisque. 12 m of water.

Circling school of small fish shows up 12:35 a.m. Also eels, 1 sole, lots of large polychaetes. But no cephalopods.

Leave this station 2:15 a.m.

Next station started 3:30 a.m. Off Thiarsouze 10 m. Lots of polychaetes. Circling fish almost immediately.

Net one side pulled up after a few minutes. But light remains on other side. Then net is lowered again.

The concentration of polychaetes here is really impressive. The animals must be poisonous, or at least distasteful. The local fish (which are also numerous now) apparently will not attack them.

Stop this station 5:30 a.m. Going closer inshore off point of
Bel Air. 5 m. Water is murky and somewhat rough. Only a few
half-beaks around. Then an occasional small sardine.
Nothing more —

February 16, 1974

Making another trip. Same route as before. Reach
Cap Rouge at 8:00 p.m. Lower net and set light immediately.
Then we go to eat. While we are eating, a lot of quite large sand-
nies appear. Net is pulled up 8:30. At this time, we can only
see fish. But there is certainly a squid (Loligo type) in the
school. The fact that we do not see it while net is being pulled
up would suggest that it must be light (pale) at the time.

When we finally do see a animal, it is already in tub. With
sardine already in jaws and arm. Quite large. Probably 1 ft.
long. Dark red in color. With silver, ocelli all over back
(perhaps elsewhere as well). Rather thrashing about. We put it
back in water. Seems to be O.K. Swims about. Still clasping
sardine. Still dark red. Gradually moves away from light.
Apparently getting paler as it goes.

This is at least another indication that "Dark" can be
either an extreme distress reaction, in some species, and/or a
reaction to extreme illumination.

Net is lowered again.

ADDITIONS: Not surprisingly, the squid released ink (3 times)
when released in water. This must be one of the species with a large
supply of ink.

The local sardines are Sardinella. 2 species. It is certainly a
Sardinella that this squid was eating.

Some sardines come swimming after net is lowered again.
But not very many.

9:20. Suddenly a large group of sardines (30-40 inds?) appears.

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Start to feed on smaller fish (larvae) in apparent frenzy. Then go off again.

Net is pulled halfway up. Near light. It is now conspicuous light under water.

Another concentration of sardines comes in 7:31. Again frenzied. "Frenzy-ing" must be efficient as a hunting technique.

Net is pulled up again 7:40. Apparently no cephalopods in this batch. Then net lowered again. A few very small fish appear immediately. Then a few sardines again. And an eel. Behaving exactly like a particularly active sea snake. Difficult to tell what, if any thing it is feeding on. If it is really feeding, the prey must be very small.

Then big school of sardines 7:55. School comes and goes. Animals apparently not very excited. Mostly feeding low. Difficult to see well.

NOTE: Perhaps remarkably, there have been no half beaks so far tonight. And only a few small polychaetes. None of the large type that were so common last week.

Speak of the devil! First (small) half beak shows up 10:24. 10:31. Now the sardines themselves are being chased by larger fish (perhaps Jack?).

Net pulled up again 10:38. No cephalopods.

On to Rufisque. Arrive and lower net 11:45 pm.

Large polychaetes arrive almost immediately. Water looks considerably dirtier than at previous station (current is also less strong).

There is at least one eel around.

No other fish at all 12:03 am. Then a single half beak, briefly at 12:13.

Going to rest 12:25

Net pulled up 2:00 am

On to next station (Bay Dakar), net down 3:10 am. Again dirty water with large polychaetes.

By 5:30 wind has come up, adding to difficulties. And there is still nothing of interest in the water.

Net pulled up 6:20 a.m. Nothing in it but polychaetes, 1 sardine, and a couple of dozen of tiny fish (larvae).

February 17, 1977

On boat again. But doing different stations.

8:35. Arrive off M' Bour. Net lowered immediately. Current is strong. Water does not look very clear. But lots of small crustaceans show up immediately. Most of them are difficult to identify. Some could even be mosquito larvae. Also some small crabs.

Actually, testing with dike, the water turns out to be very clear. Much clearer than usual for region!

Small fish start to come in 9:00 p.m. Then some eels.

We are running 2 lights tonight.

Depth here is 12 m.

Then a few large polychaetes show up. Probably not (quite) the same type(s) seen on earlier nights.

Then a Uranus. Then some ribbon-like siphonophore colonies.

A band of pearly sardine-like fish appears, rather low.

10:20 Start to pull up net immediately. Lots of anchovies. No cephalopods.

Going on to next station. Mouth of the former. Net lowered.

11:55 p.m. Water is a little less clear here than at previous station. Depth is also 12 m.

Lots of small, active polychaetes appear at surface almost immediately. Then a few small fish. Then a siphonophore colony. Then one sardine. Then more siphonophores. And one small petrel.

1:50. A really big half beak or needlefish appears.

Net pulled up 1:55 a.m.

On to next station. Cap (or Pointe) Rouge (again). Net put down.

3:45 p.m. Water seems almost empty.

Only a very few small polychaetes, 1 or 2 "minnows" in next 10 mins.

This situation continues with very little change. Very different from last night!

NOTE: depth here is (again) 11 m. Water is about as clear as at last (second) station.

One big fish 4:53 a.m. Comes and goes. Then an eel appears. Doesn't stay long.

Big school of fish circling 5:37 Very tightly packed. Obviously being preyed on by something. At first low in water, difficult to see. Gradually rise nearer to surface. I can't see what, if anything, is bothering them. Then a second, smaller, group appears. The 2 groups do not merge.

Net is brought up 6:10 a.m. No cephalopods.

February 19, 1947

I did not go out with boat last night. So, of course, something interesting showed up. At first station, Pointe (Cap) Rouge. Presumably usual place (depth) for collections.

3 little cuttlefish-types. Species and genus unknown. They were watched and caught by M. (the winning german scientist from Kiel)

According to him, these 3 little things came up to the surface, to the lights, one by one. I.E. they are pelagic at night and non-gregarious. He says that they were dark when they first appeared.

He captured them and put them in bucket. They stayed dark in bucket. Until one ind. managed to find a shady part. At which point, this individual turned pale. I.E. the species seems to have usual cephalopod (or squid?) habit of going dark in light and light in dark.

M says that the 3 inds. kept well apart from one another in bucket. Each in its own "corner".

When the boat got back, M had the 3 cephalopods put in large tank (approx 15' x 8'?), in which there are also Sardinellas, anchovies, and doubtless many other things. They went to bottom. Apparently scattered a little, but probably not far (at first). Presumably just enough to keep out of one another's way.

NOTE: this tank is at the station or center of the Centre Océanographique at Thiarouye.

I don't hear about the capture until noon. Don't get to Thiarouye until 2:00 pm.

In the meantime, some changes had taken place. One of the technicians had cleaned out part of the bottom of the tank scattering the cephs even more.

When I arrive, it is more difficult to see the little things. (There is a tin roof rather low over tank. Visibility is reduced.) Finally see one. On bottom. Pressed up against side of tank most of the time. I.E. these individuals probably live on or near bottom at night. And they probably are not (much) more gregarious during the day than they are at night.

The first ind. seen is dark.

We go looking for others. Find one of the others at far end of the tank. Can't find the third.

These 2 inds. are picked up and placed into dip net near surface of water. Depth of water in net probably reaches 4" in places.

One ind. (the only one I saw) turned very pale when taken out of water.

But both inds. turn dark again immediately when released into water of dip net. Both go down to bottom immediately. One retreats into wrinkled corner (a "hole") and stays there. Almost completely hidden from me. (Presumably retreat into holes is "natural" and would occur in the wild.) The second settles in middle of bottom. Just "sits", arms swept sideways and under. Arms almost invisible most of the time.

Both inds. return dark. General effect is dark red. Yellow on center of back. Gray on front sides mantle. Darkest top eyes. Some body organs visible from above. SEE SKETCH.

Twice ind. in center goes to corner where the other ind. is hiding. Apparently tries to get into hole too. It is not allowed to. No real grappling. But doubtless some contact of arms. Then the approacher hovers a few cm. away. Going back and forth. Then I scare it away.

As far as I can tell, there is absolutely no change in color by either ind. during either of these encounters!!!

Are these inds. too small (too young) to be able to produce elaborate

color patterns ??? Their chromatophores are, of course, substantially enormous. Quite visible to my naked eye.

Everyone settles down quite as afternoon wears on. One ind. in center. The other still in corner. I think that they are sleeping.

The visible ind. gradually becomes slightly, but only slightly, paler.

NOTE: neither ind. has done any Inking while I have been here. Has their supply run out? I must ask M if they Inked when captured last night.

3:45. I disturb both inds. a little. They are very reluctant to move. So I leave them alone again.

The visible (Center) ind. turned darker (again) as soon as it was disturbed. In spite of the fact that the disturbance was not accompanied by any change in light intensity. Except, perhaps, my shadow. So these inds. do have a real, ritualized "Dark".

These inds. look as if they have triangular, squid-like fins. Rather than continuous cuttlefish-like bands. If they do have cuttlefish-type fins, the chromatophores are cunningly arranged to produce a squid-like effect.

Actually, I have no idea if these animals are cuttlefish or squid. Or whether they are adult or young. Or if their shape is typical of adults or not.

4:01 pm. Center ind. suddenly starts swimming around enclosure. Backward jerks. Somewhat erratic. Looks almost as if it is having a fit. Or perhaps wrestling with "prey" ??? Then goes to corner where the other ind. is still hiding. Stops outside. And then gradually oozes itself into hole. Starting head and arms first. But then turning around. Completes entry, rear first. Then settles right next to other ind. Their rear ends are touching part of the time, separated by only a few mm. at other times. As far as I can tell, the ind. that has always been in hole does not respond in any way. Also (again) as far as I can tell, there is no color change by either ind. at any stage of the joining process. Both are dark now. Quite dark.

NOTE: this corner "hole" probably is the deepest part of the nest. The inds. probably are looking for deep & dark refuges. I wonder what depths they sink to in the wild?

4:15. Now the 2 inds are side by side. Apparently in full side contact. Still same color.

NOTE: Last night must have been the new moon or just after. I.E. very dark (And I am not sure that the moon had even risen yet at the time the animals were caught.)

4:28. Both inds. move around a little in their corner. No color change. Settle down quietly again, about 1" apart. Then one gradually oozes closer to the other. Until they are in rear-side contact again. Apparently they avoid face to face or arm to arm contacts.

I still can't find 3rd ind.

PARTIAL CORRECTION: 4:40 p.m. Now the 2 inds in dip net are side by side. Both with arms extended in front. I.E. curving under and hiding of arms under head and body does not occur in "holes" (or at least is less extreme). Both inds. move arms slightly almost continuously (yet from funnel?). So their arms must touch occasionally. But only "laterally".

Animals still asleep as before 5:00 p.m.

Unfortunately the dip net is getting a layer of mud on top. I clear it up as best I can. Which is not very well. The process doesn't disturb the animals at all. I presume that cephalopods, unlike fish with lateral lines, are more or less insensitive to waves on water?

Disturb the animals more seriously 5:12 p.m. Force them out of their hole. One ind. comes out more or less willingly. It seems to be in relatively good shape I shall call it "A". The other (probably the first to go into hole) comes out very reluctantly and apparently with difficulty. It looks as if it might have rear end damaged. I shall call it "B". Both inds. go to middle of net. Then settle down, side by side again. No color change by either. A settles down with arms curved down and to the side. From the front this looks almost like a split E by Sepioteuthis! Actually it may not be a display or anti-display at all. I think that the arms, or the suckers thereon, may be grasping much of net. A actually seems to walk or crawl on its arms a few mm. B, on the other hand, just keeps its arms more or less extended in front. Presumably a sign of weakness.

After some minutes, B gets restless. Gradually, haltingly, goes back to first hole. A remains behind in center.

Neither ind. is showing any sign of getting ready to hunt at dusk! Going to leave myself 5:38 p.m.

February 20, 1947

Arrive back Thiarouye 8:00 a.m. One of the cephs, presumably B₂, is dead. Turned very very pale in death. I pick it up and preserve it in Formalin solution. Color does not change (at least at first).

The other ind. is in corner hole. Seems to be alright. Dark.

NOTE: The pickled ind. does seem to have wing-like fins

When I disturb the surviving ind., it moves out to center net as usual. No color change, still Dark. Swims slightly above bottom. Then immediately settles on bottom, arms curved down just as yesterday. Again no trace of Dubuig.

Turns slightly paler after being settled, apparently asleep, 10-15 mins.

When I disturb it again, 9:05, it swims off just above surface. Turns Darker as soon as it starts to move. Then settles again as soon as possible. And it definitely does crawl along bottom for a few min while settling in (making itself comfortable). I suppose that it might well bury into sand if sand was available.

ADDITIONS: these animals were caught at 8:30 p.m.

M says that one of them did ink after being captured

O went to M'Boor market yesterday afternoon. She says that the fisherman had caught (off shore) lots of large cuttlefishes, presumably Sepia officinalis. Only large inds. Up to 6-8 K yesterday. The local fisherman claim that the local cuttlefishes can go up to 10 K.

Are these animals getting ready to breed?

February 21, 1947

Arrive Thiarouye 9:15. To find single ceph still alive. Has been changed to another dip net for some reason or another.

Going to try a small experiment. Putting animal in (white) basin, with sand on bottom and several inches of water above it. Fluid is relatively clear, light, and smooth. Only a few briniae shelves and rocks in it.

Transfer occurs 9:25 a.m. Animal remains Dark (at least on top) throughout. No urking. Immediately goes to edge of basin, rests there. On bottom (arms curved down and behind as usual). Rear end against side of basin. Just sits. Tunnel of course, is working steadily. The jets of water form little furrows. First forward, then gradually moving backward along side. Characteristic pattern. Small wall or barricade outside furrows.



This does not actually help the animal to get into sand. Every once in a while, it also seems to seize something in arms (grains of sand?) and either tries to swallow them or drops them. It is difficult

ult to see which.

Then the animal moves a few cm. down side of basin, repeats performance as before.

Again.

Perhaps this species does not burrow???

All this occurs in shady half of basin.

Animal remains Dark above. This is not cryptic, in fact, in these circumstances, against light sand. But it might well be cryptic in many situations in the wild. And now I notice that whole underside of body (mantle) is silver, white. Below fin line. Line of demarcation is sharp. Quite conspicuous. I would suppose that I would have seen it, not used it, if the animal had done this on previous days. So perhaps it is a new pattern. Is it an adaptation to being on continuous substrate. I.E. there is no point to being cryptic on bottom side which can never be seen by anyone.

Then animal changes position. Faces diagonally into run of basin. Lying slightly on one side. Raised side is Dark to level below fin.

It seems to have stopped making furrows!

When disturbed, it moves 1 cm and then sits as before.

Then tells to other side. White underside is quite exposed in this position. I.E. white may be permanent. Or perhaps a sign of physical damage?

The animal still is not buried at 10:25.

It may just possibly eat some finely chopped fish put into water.

ADDITION: Miland ("M") looked at the animal yesterday afternoon. It was, at the time, resting peacefully in its corner hole. And Miland says that it was quite Pale. Turned Dark again, as usual, when disturbed.

Thus, it would appear that ambient light may have little to do with (their) color changes.

Back to Thudlowe 1:30 pm. Animal has been shifted to a large tank, with sand on bottom, which might, conceivably be adequate for it. When I arrive it is sitting peacefully on bottom, in Dark, in center away from side. This area was rather somber, before I arrived, because tank was partly covered. When I remove cover, animal is left in sunlight. Stays there a couple of minutes then moves into shade. Sits.

This species obviously likes the dark!

NOTE: This tank is at least several (3?) ft deep. And the animal is sticking to the bottom (during the day). I.E. it obviously goes as low as it can (within reason).

I leave again 1:45 pm.

Back again 7:15. Just getting dark. Animal still alive. Still on bottom of tank. And still dark.

Moves about on bottom from time to time. Apparently not swimming. Certainly not swimming high in water column 7:32.

Apparently more active now than in daytime.

7:43. Quite dark outside now. Shine light. Animal still on bottom. Makes funny little "hops" away from light. Generally a little paler (than before) between hops. And then pales much more, briefly, during hops.

Movements are funny and erratic. It seems quite possible that the animal is not in good condition.

Shine light a few minutes later. Animal very pale now. Rolls over and over. Then lies still. Apparently dead.

April 9, 1945
Islas Secas

Reach Cavada late in afternoon. Going to run light at night.

Light goes until 7:50. Then off. On again 10 mins later. Lots of sardines. One eel (sea-snake mimic?). Stop 10:15 pm.

April 10, 1945
Islas Secas

Make 2 separate swims this morning. One along shore of Cavada. The other along shore of an adjacent island (name unknown). Sunny and windy. Strong surface. Water very murky. Swim over sand, rock, some coral. Nothing of interest.

This afternoon try a swim around an isolated rock called Las Brujas. Still sunny and windy. Swell. Lots of big fish. But still nothing of scientific interest to us.

Later ca. 3:15 pm. Go back to Cavada. A new side of the island, not the one that we visited yesterday (or this morning). Weather still the same. Swim near shore over a variety of environments, mostly coral (Porites?) and rock. No squid. But lots of fishes. Most numerous species is the "squid mimic" ("SM"). Literally thousands of inds.; in separate groups of hundreds. 2-10 ft down in 6-15 ft of water over all sorts of coral and rock.

Ceph., Apr. 10, 1975, II.

(4)

Still very squid-like. Frequent changes of direction of swimming movements. (Occasional backward dashes? Short. Look like squid hunting.) Schools of SM sometimes dispersed. Concentrate when apparently frightened. But I did not see any actual predation. SM's seemed to ignore large puffer-fishes, parrot-fishes, etc. Perhaps some tendency to associate with wranes (brown & yellowish green). Apparently friendly.

Huke Bolton photographs SM.

Going to run light same place tonight.
Lots of fish but no squid
Stop 10:15 p.m.

April 11, 1975

Go into Las Virutas, La Ventana this morning.
Water too muddy to work.

Go out to Contreras Islands in afternoon. Anchor off one of the large islands (Contreras s.s.? Brunicauco?).
Dive 5:30-6:00 along shore. Rock and coral. Lots of fish. Medium sized barracudas. 1 large white-tipped shark. No squid.

Running light at night.

7:10 p.m. Group ca. 20 small squids appears.
Young Lolliolopsis? Rather scattered, 6"-2' apart
Pale. Some traces HD. Apparently not fixated by light. Go straight on by.
Nothing more until 9:15-9:30 p.m. When we stop.

April 12, 1945
Islas Contreras

Still at Brncauco this morning. Clear. A little wind. We take a long swim, ca. 7:15 - 8:45. First swimming near surface in deep water, gradually going over to shallows and shore. No squid. Then A and Mike go hunting along rocky shore and reef. Lots of fish, but still no squid.

NOTE: A and Mike have been exercising the submarine regularly throughout this trip. Without much success. SANC

Later in the morning go over to Iva. Miscellaneous swimming in shallows. Water murky in most places. Fairly clear in some spots. Crown-of-Thorns. Fish. No squid.

NOTE: SM seems to be the most abundant fish in both Secas and Contreras, in shallow water over coral and/or rocks. Why in the world should a species of this type be a mimic of anything? Much less a squid? Is it that squid are more agile, if not faster in the long run ???

Two more swims in afternoon. One, ca. 2:15 - 3:15, along rocky shore far out point. Second, 5:15 - 6:15, open water of bay. No squid.

Running light at night. Until 9:15 p.m. Without success.

April 13, 1945
Islas Contreras

Two more swims around Iva this morning. No

Ceph., April 13, 1975, I

(6)

squid.

As usual, lots of SM's. I have been watching them as carefully as possible. Very tame and bold. Don't seem to worry about predators at all.

Go on to region of Coiba in afternoon. Swim around Ranchería 4:40-5:30 pm. Coral and rock. Water still murky. No squid.

Going to run light off Ranchería this evening.

One or two "larval" squid may drift by; but we can't be absolutely certain about them.

A sees Lolliguncula (1 ind.) from sub. SAN.

April 14, 1975

In mid-morning, we go from Coiba to Canal de Afuera. A and the kids see 2-3 squid near surface in middle of channel between the 2 islands. Apparently Loligo-types.

Various swims and dives around Canal de Afuera.

A thinks he sees ink ca. 80 ft down near shore.

Run light at night. Nothing



July 22, 1973
Panamá

Marine Lab 2:45 pm.

We suddenly find that one of the Lepiot eggs has hatched.
Tiny young swimming in water. Dark with definite V
(tentacles still very short). Plus one dead by drainage tube.

2:55. Another hatches! In semi-dark. Arms sort of spread,
no real V (yet). For first few minutes, swims forward (very occasion-
ally backward) in short spurts (hatching movements ???). Has
slight tendency to bump into walls of tank. (The first ind. hasn't
bumped once since we started to watch.) Then shows one trace of V.

Inds. perhaps 15 mm. long? Quite plump.

Others in eggs apparently trying to hatch. Making lunging
backward movements.

NOTE: Young in eggs are colorless. Only eyes and something
else (ink gland) visible.

Second young bumping steadily against side. Exploring?
(Natural? V. situation in suchs.) No V 3:10 pm.

3:16. Second has stopped bumping. Still semi-dark. Still
no V. First still in Dark and V. Hardly moving at all. Just drifting.

No more hatching for the time being. (Note: there was a
cover on tank when we first arrived. We have now removed top.
Do the eggs naturally hatch at night ???)

One turns dark in egg. Then pale again.

Some are actually turning around in eggs. 3:24.

ADDITION: I forgot to mention that the first shot out a puff
of ink (blackish) immediately after we arrived, when we poked a finger
at it.

3:30. Now both inds are in Dark and V. Just floating (doubt-
less moving fur; but this is difficult to see).

Second ind. stops V.

3:40 Put cover back.

3:50. Take cover off. One in Dark and V. The other more
or less pale without V.

3:54 Now one Dark & V, the other Colorless & V

4:10. One consistently Dark, the other consistently Colorless. Colorless one in shadowy part of tank. Dark ind. is usually on more illuminated side

Now both Dark and V again.

NOTE: All or most of young in eggs still have quite conspicuous yolk sacs.

July 23, 1973
Panama

Early this morning there were no more eggs hatched.

This cluster is transferred to adjacent tank, which has unfiltered water, for some appreciable time. SAN. SON. At which point, several more hatch. Then transferred back to original tank (This has had unfiltered seawater since yesterday afternoon)

NOTE: According to both A and O, several (or all?) of the young hatched with yolk sacs attached. And then shook off yolk sacs as soon as possible.

When I arrived, 2:13 pm., there are at least 8 young in tank. Somewhat variable in color. Usually 5-6 in Colorless, 2-3 in Dark. Possibly usually same inds. in Dark.

Colorless inds. are relatively calm. Usually fairly close together (in semi-line, only a few inches apart). Either relaxed or weak.

Dark inds. are more scattered and more active. Doing some bumping into sides (Colorless tend to congregate in relatively quiet water near center). One of the Dark is so active from time to time as to be almost convulsive.

Both Dark and Colorless show occasional V-Curves. Perhaps a few V-Forwards. Both also show occasional movements which look like feeding.

Are the Dark more recently emerged - younger and shyer - than the Colorless ???

Still some embryos in eggs. One turns Dark briefly, then pales again.

See SAN about
hatching colors

Dark presumably alarm under these circumstances
I go away for a while.

Come back 3:40 pm. Find 17 inds in Dark! Some in unusual postures. Some in V, V-Curl. One does E! The eighth ind. is in Colorless. Also in V-Curl.

All inds. usually quite close together now.

A few minutes later, only 2 Dark. Rest Colorless (again).

4:05. See another Colorless on bottom. Just hatched. Or dying???

Situation unchanged. Leaving 4:55 pm.

July 24, 1943
Panama

A says baby squid fed last night.

He transferred eggs to new tank in Bunker this morning. And about 8 more hatched during or immediately after the transfer! SAN. I.E. disturbance facilitates hatching.

Are there young "prematures"?

I arrive 2:10 pm. Find approximately 13 young. One in Colorless, "bumping" along bottom. The rest in more or less Dark. Most with V-Curl, V-Forward, or V-Downward. NOTE: It is quite light in here now. Some of the Dark may be response to strong illumination. Just as in the case of adults.

Dark inds. in mid water or near top. Apparently in two loose, irregularly shaped groups. One of 4. The other of 8.

One of the Dark is very small. Still has yolk sac attached. But swimming around moderately actively. Apparently normally. (NOTE: Yolk sac uncolored).

Actually, there are 2 usually Colorless inds. doing a lot of "bumping". One is also "sommersaulting".

2:35. Several inds (3 or 4) pass from Dark into what is obviously "primitive" or "primordial" Bar. Just 2 bars on back. One, toward rear, darkens to a "blob" on each side of body or on fin. Obviously "primordial" DM! Other bar is at

front of mantle

Head medium-dark

Don't know if fin shape
is correct

SOP

As far as I can tell, there are no bars below at the time.

Well! Well! One of the more "disturbed" inds. that is
lumping against the side and turning over occasionally is
in pure Colorless or Colorless plus what seems to be a peculiar
sort of "Infantile Fin Stripe." Sharp thin line along base of
fins (i.e. along only rear half of body). With a connecting line
underneath!



Top view

Center spot
is ink gland

Bottom

(Not quite sure of
shape of line).

Is this "normal" ???

3:07. One baby still in egg is turning around quite
freely in all directions.

3:30. Now 7 out of the 13 inds. are completely Colorless.
The rest dark as before. All fairly placid. Still some Curls & V's
Leaving 3:35 p.m.

What is size adult Dorys ???

Doryteuthis ①

Nov. 20, '41. Night. Group 35 inds. Narrowly circling, very close together. Not feeding most of time. One ind. may have struck at anchoveta 6-8" length. Then see single ind. alone. Species obviously has flexible social organization.

Nov. 22, '41. Night. Again single ind. at lights. Same on Nov. 23.

May 3, '42. Again group at night. Quite far from nearest island (1/4) mile. Species presumably more open water than before.

May 5, '42. Paravertigo 3-4 inds with group (incl group) of Sepiots. Sepiots small to sub-medium. 1-2 ft above bottom, in 6-8 ft water. TG flat. Dorys same size. 2-3 young? Sometimes distribution random. Sometimes species clustered. Dorys and Sepiots move together (at least in a mass) Dorys "adapting" to Sepiots (moving at same speed). General comment ca. p. 187.

Then see group 50+ squids, including 10+ Dorys ⁽²⁵⁾ 2 ft up in 6-7 ft water, center TG bed. Sepiots small. Dorys presumably same size. Dorys grouped together. Spaces between Dorys same as spaces between Sepiots. No unusual spaces between species.

Diagram p. 187.

Inds. both species retreat together. One, at least, Sepiot in lead. (Must be significant that we don't see Dorys without Sepiots in daytime). Dory movements slower than those of Sepiots.

Dorys HD while Sepiots are horizontal.

Some Sepiots in large mixed group are larger than the largest Dory.

No feeding by either species in mixed groups.
Single Dory at light at night.

Doryteuthis (2)

May 4, '72. Single Dory joins group small sepiots in 10 ft of water over TG. Maintains same individual distance as sepiots.

June 24, '72. 19 Large sepiots. 8 Dorys. 6 of the Dorys are large (as large as any seen by A in Washington) 2 Dorys are smaller (mediums?). All inds 1-2 ft up, in 10-15 ft water. Over sand and coral. Then over sand and TG sepiots counting. Dorys definite subgroups.

Dorys do some displays. To us? Display less than sepiots.

Diagram p. 233, p. 234. Dorys in center.

Sketch Dory p. 235.

Group stays together all day. But fewer inds of both species in afternoon. Dory asleep 1:20 p.m. Then group snells again. Little.

Dorys display pp 238 et seq. To fish? To us? Sepiots court.

Clutered near green alga. Halimeda opuntia. No X's morning of June 25.

Aug. 25, '72. 1 young Dory in group 60+ young sepiots. Dory dashes among with sepiots, maintaining relative position.

Aug 27. Single Loligo type at light at night.

Oct 4, '72. Dory and medium-small sepiot pooled up in same dip of net.

Doryteuthis (3)

Nov. 6, 72 Mixed group. 2 large medium sepiots +
3 Dorys same size. At night at lights. Apparently all travelling
together. Then single Loligo type back alone.

Pop cycles may be different in Dorys and sepiots, p. 367

Dec, 72. Arcadio. Dorys at light at night. Also V-octopus
(Craneus?) Not associating. Then sepiots. Again no association.

June, 73 Arcadio. Dorys at lights at night. Not associated
with sepiots.

Then associated with one sepiot.

But species usually are not closely associated.

✓ 1 Loliginuscula large with mixed group large and medium sepiots.
Arcadio July 6, 1973

Pinkfordinia adult(?) 1/2-1 ft up in 7 ft water over
TC. Alone.

July 5, 1973 Night. Tightly integrated group of sepiots and
Dorys. Dorys matching their speed to that of the sepiots.

✓ July 6, 1973. 1 large, 5 medium large sepiots. Plus 1 presumed
Loliginuscula, approximately same size.

Aug 73 - Loliginuscula - Dory association. Bocas del Toro.
at night by light.

Doryteuthis (4)

Arcadio. March 11, 1944 100 + medium small sepiots
and 2 large Dorys. At first 2 Dorys not together. But then join
up. This in murk at Cant.

Loligo pealii present. Night Large Arcadio Apr. 4,
1944. Morpeptuppu alone

Arcadio Morpeptuppu Apr. 5, 1944. 40 + smalls in deep
water. Into just below surface. Include both Dorys and sepiots.

Barrocinia attala 1976

Half-beaks, *Hemirhamphus*, often in same areas. Higher in water. More active in daytime (?). Feeding same foods. But no interaction. Definitely positively ignoring one another.

Telligerocula No visible interaction. Ecological separation.

No visible interactions with Octopi.

React to pomies among fishes

Tend to avoid areas where *Diadema* are particularly abundant. Certainly avoid areas of cucumbers.

Pukforliatenthus like larval Sepiots

General ignore invertebrate fishes

Gray & Yellows definitely stay close to Sepiots. Grazing. Raye munda said p. 154.

Swimming octopus May 3, '72. What species? Possible competitor?

What is next-guarding *Pomacentrid* ???

Group of Sepiots drifts over to site where G+Y's are grazing. Then away again. Do they expect to catch prey disturbed by fishes? p. 174

Spotted Goatfishes associated with Sepiots less frequently than are G+Y's?

Spotted over mixed bottoms.

Sepiots move aside when cut moves thru group.
Sepiots retreat before Surge wrasses (Acanthurus)

Spotted Goats follow squids

Goats may follow other fishes as well as squids.

Wrasses with goats (Spotted) with Sepiots. Always same
size as Sepiots? Anadur, March 7, 1944

Predatory fishes:

Barracuda

Hansen Groupers

Snappers

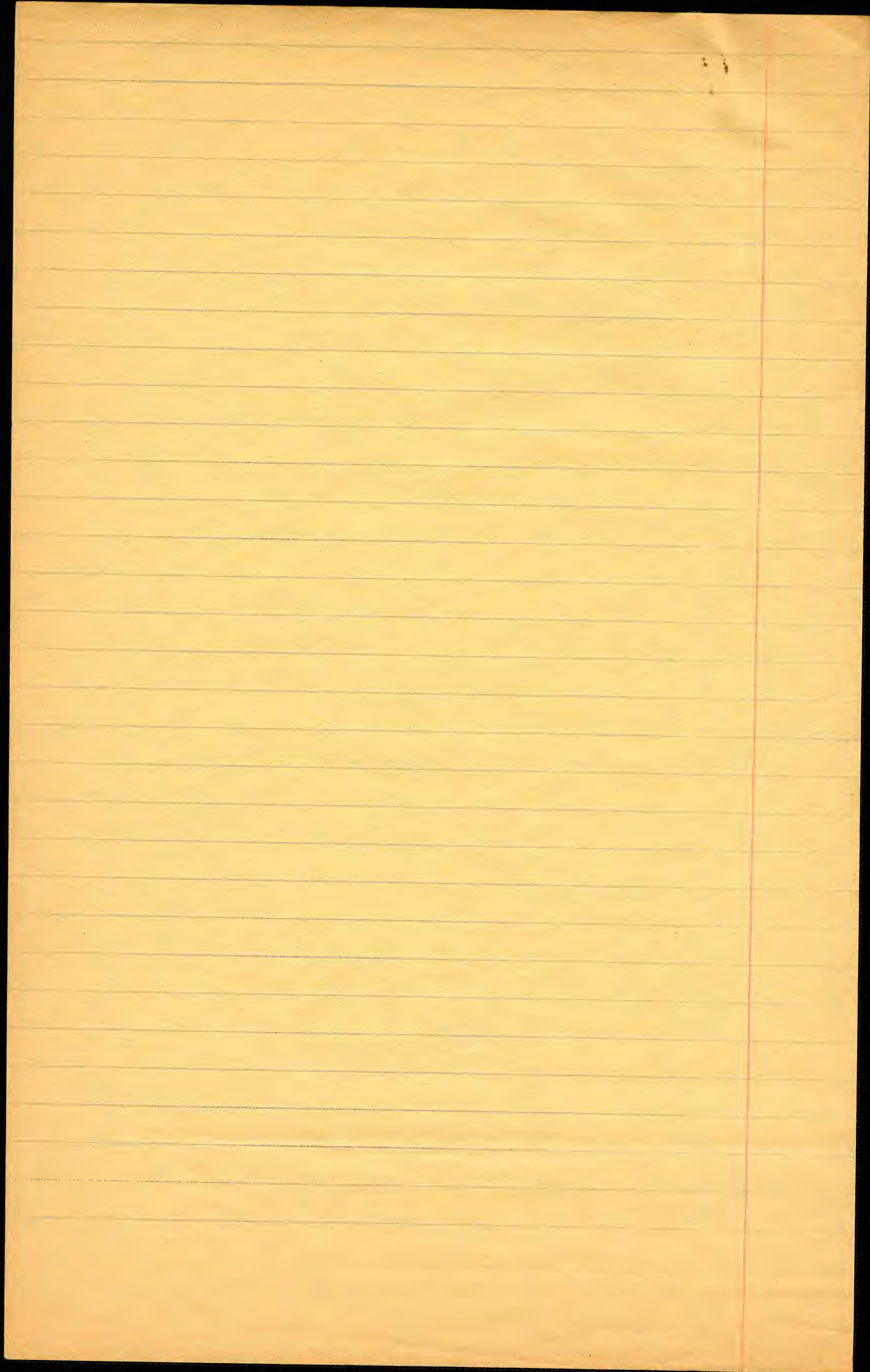
Blue Runners, Caranx fuscus, seem to cause intense fear.
Even tho we have seen no attacks

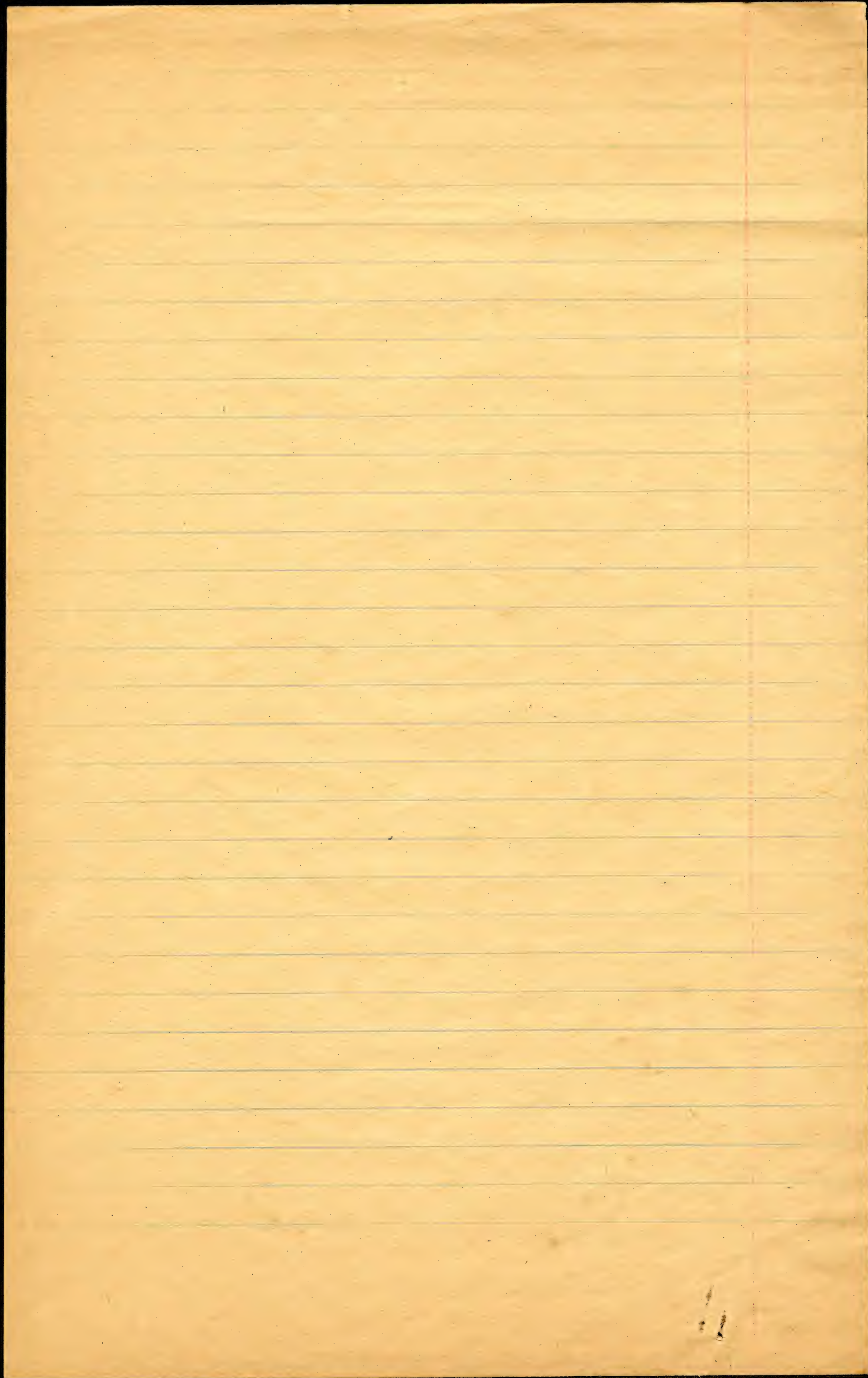
Not so afraid of Hammerhead

Not afraid of small Caranx ruber.

Then take refuge in TG from large ruber

What is name Staghorn Coral?





Infants

Nov. 71, Salar. Larvae. In boat. 2 inds. A few ft below surface in 20 ft. Ord. Pie? V. Inks

Feb. 72, Pico Ter. 1 baby. 3 ft up in 4 ft of water over Turtle Grass. Then 1 very small. In shallow water inside rocky barrier. Bar and V. Then another. 1 inch down in 1 1/2 ft water. Also Bar and V. *Mimichius sanguineus*.

June. 72. Ponetupo region? Babies in group of 40+ inds. (including large-ish smalls) In 5 ft water over TG. Ord, WS, Y, PCA. Obviously a nursery.

Aug. 72. Between Morpeptupo and mainland. Suckles in open water. Over TG. Then "larvae" 2 inds. Six inches below surface in 5-6 ft water over TG and sand. Considerable difference in size between the 2 inds. Yellow Whitish Split. Fin stripe including Dark. Curled Y. "Freckles" Pale. V. pp. 307 et seq. Bar. General comment 311

Nov. 72 Nalunega 2 ft up in 5 ft water over TG flat. P, PH, DM. Splay. Fin stripe etc. Drawings 344-345 V Split. Bar?

Dec. 72 Nalunega 2 very smalls at night. Reddish

July 73 Carti Split Dark arms. Pale body. 1 ind. 6 ft down in 20 ft of water. In turbid water

March 74. Morpeptupo? By anchor rope

July 74 Uatupo?

Distribution in Panama (Description, San Blas).

The San Blas Islands begin at Punta San Blas, a point 100 kilometers Northeast of the City of Colon. It arches parallel and less than 20 kilometers from the Caribbean coast of Panama in a Southeasterly direction for about 160 kilometers to Punta Escoces near the border with Colombia.

The Archipelago is formed by several island groups, each separated from the other by deep channels. The outer groups, those facing the open sea, are protected by a well developed algal reef formed by ^{CRUSTACEA} ~~crustacea~~ coralline algae and vermetid gastropods (Glynn, 1973). The area between the algal reef and the Islands is a vast shallow flat of sand and turtle grass, Thalassia testudinum with sparsely scattered heads of coral. The islands and cays are located at the leeward end of the sand flats. The islands' leeward side is a steep, sometimes vertical, face of firm strata formed by hard luxuriant corals to depths varying from 5 to 30 meters.

The inner islands, devoid of an immediate algal reef, are structured similarly except that their steep coral face is on the seaward side and the shallow sand flats usually occur on the side facing the mainland. Each island is surrounded by patches of sand shallows and T. Testudinum flats on one side and fringing coral reefs that drop sharply to a bottom of coral rubble and sand to depths of 5 to 30 meters.

All field observations and pertinent data were gathered in the San Blas Archipelago. However, in order to verify the occurrence of the species throughout the Caribbean coast of Panama, eleven stations were examined starting at the San Blas Islands and extending to Almirante Bay in Bocas del Toro province, bordering with Costa Rica. S. sepioidea was evident in all stations.

Cop. & CountBalues

May 71, Porvenir ✓
 June 71, Matupo C. ? ✓
 July 71, Matupo ✓
 Feb. 72, Matupo C. ✓
 Mar. 72, Ogupukip ✓
 Apr. - May, 1972 Matupo. C. ✓
 Apr. - May, 1972 Ogupukip. C. ✓
 June, 72. Halunega C. ✓
 June, 72. Piriatupo ✓
 June, 72. Matupo C. ? ✓
 June, 72. Ogupukip. C. ✓
 July, 72. Halunega C. ? ✓
 Aug, 72. Halunega ✓
 Aug, 72. Matupo. C. ✓
 Aug, 72. Ogupukip. ✓
 Aug, 72. Morseptupo ✓
 Oct., 72. Ogupukip. C. ✓
 Nov., 72. Ogupukip. C. (Not as common as earlier) ✓
 Nov., 72. Piriatupo ✓

Nov. 71, Salar
 Feb. 72, Pico Feo.
 June 72, Panetupo
 region?
 Aug., 72. Between Morsep
 tupo and mainland.
 Nov., 72. Halunega?
 Dec., 72. Halunega?
 July, 73. Carti
 March, 74. Morseptupo?
 July, 74. Matupo?

Dec., 72. Piriatupo. ✓
 Dec., 72. Ogupukip C. ✓
 Jan., 73. Ogupukip C. ✓
 Jan., 73. Carti ✓
 Feb., 73. Matupo ? ✓
 Feb., 73. Carti ✓
 March, 73. Matupo ? ✓
 March, 73. Carti C. ? ✓
 March, 73. Matupo C. ✓
 May, 73. Sail Rock. ✓
 May, 73. Matupo. C. ✓
 May, 73. Ogupukip C. ✓
 July, 73. Halunega C. ✓

Egg-laying

May 72, Piriatupo (Holander's end)
 July 73, Halunega
 July 74, Soledad Manduiga (Munutupo)

July, 73. Ogopukup. ✓

July, 73. Morpeptupo. ✓

July, 73. Harascanupopo Pipigua? ✓

✓ Aug., 73. Coes Cay, Beas del Toro.

March, 74. Ogopukup C. ✓

March, 74. Island adjacent to Morpeptupo. C. ✓

Apr., 74. Carti ✓

Apr., 74. Quinguntupo ✓

Apr., 74. Ogopukup C. ✓

July, 74. Piriatupo C. ✓

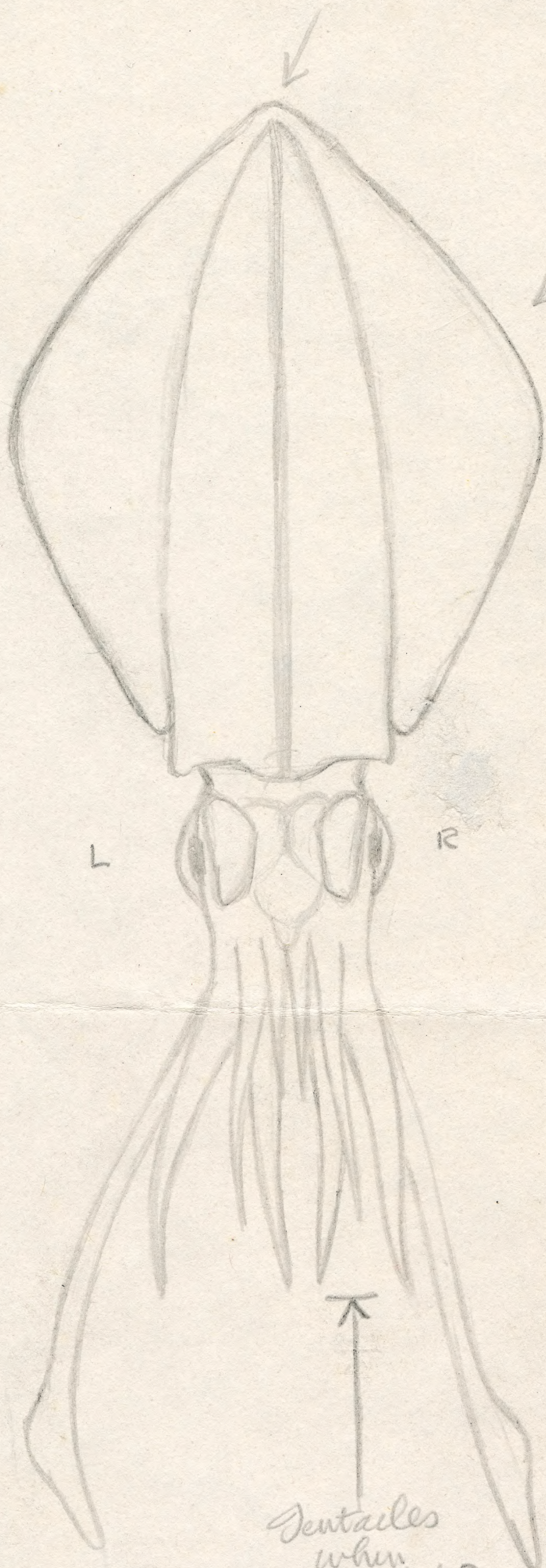
July, 74. Ogopukup C. ✓

July, 74. Harascanupipi C. ✓

July, 74. Soledad Mandinga ✓

May 18, 1971. MM ✓
June 11 - June 13, 1971. Both ✓
July 24 - July 28, 1971. Both ✓
~~Nov. 3 - Nov. 4, 1971. A.R. (?) X~~
Nov. 20 - Nov. 24, 1971. Both ✓
Jan 29 - Jan 30, 1972. A.R. ✓
Feb. 16 - Feb. 18, 1972. Both ✓
Feb. 22 - Feb. 23, 1972. Both ✓
March 22 - March 25, 1972. Both ✓
Apr. 27 - May 7, 1972. Both ✓
June 21 - June 28, 1972. Both ✓
July 29 - July 30, 1972. A.R. ✓
Aug 24 - Aug 30, 1972. A.R. ✓
Oct. 1 - Oct. 8, 1972. Both ✓
Nov. 3 - Nov. 11, 1972. Both ✓
Dec. 4 - Dec. 10, 1972. Both ✓
Jan 24 - Jan 27, 1973. Both ✓
Feb. 16 - Feb. 20, 1973. A.R. ✓
March 26 - March 28, 1973. A.R. ✓
May 18 - May 23, 1973. A.R. ✓
June 30 - July 8, 1973. Both ✓
Mar. 9 - Mar. 14, 1974. Both ✓
Apr. 3 - Apr. 9, 1974. A.R. ✓
July 6 - July 12, 1974. Both ✓

Florida to Venezuela



Fin broader than
half body

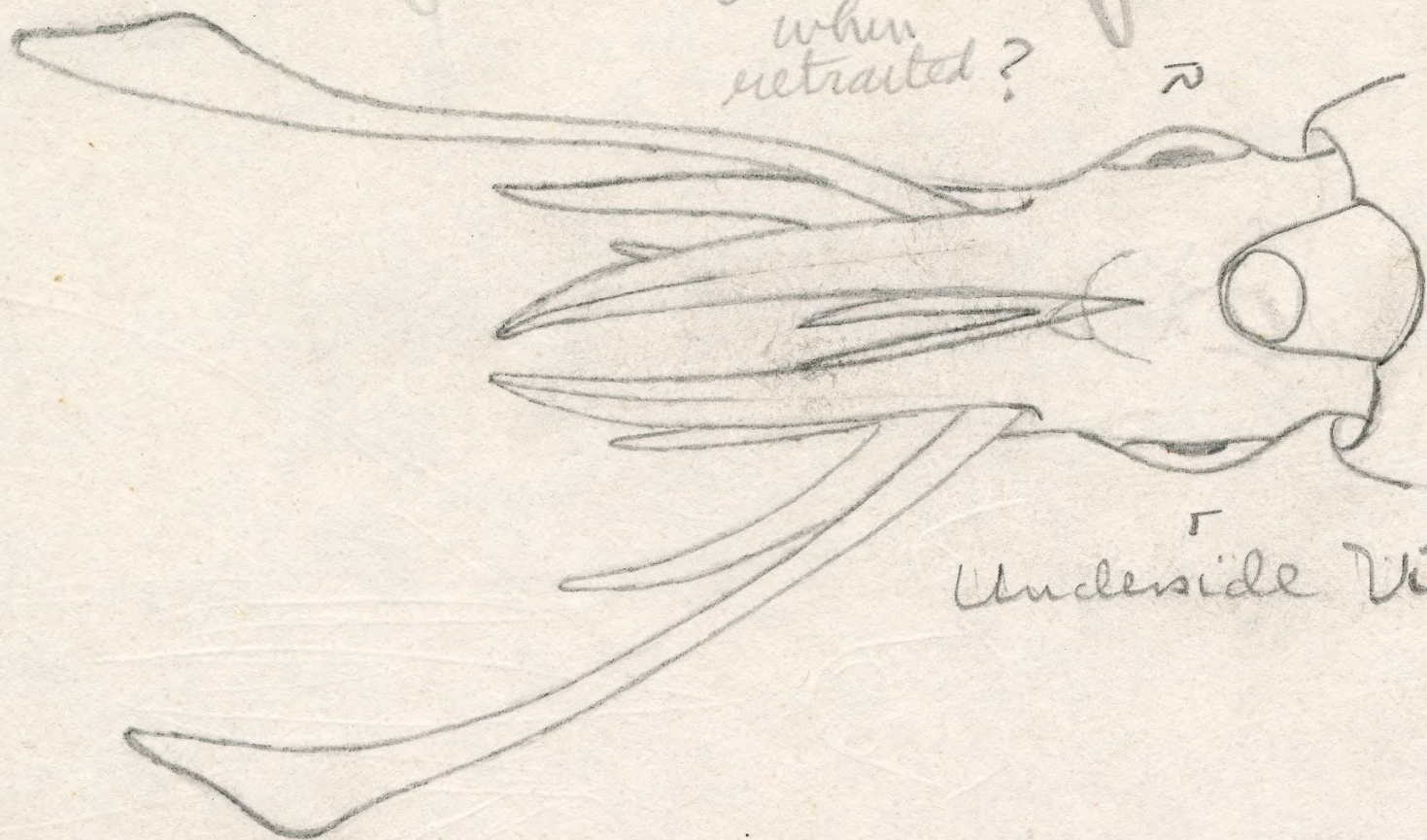
Medium
Individual

3 arms on top, getting
progressively broader
from center outward

Tentacles drawn
extended (but
not to full extent)

Pair of arms below
similar to outer
pair of arms above

Tentacles
when
retracted?



Underside View



Dorsal view
of one form of
arm "blob".
Blob can be more
retracted at times.

Is there a special
"Dark Eyebrows"
pattern ???



Fin shape
may need change.

A.T.R.

Spots perhaps
too large for pure
colorless.



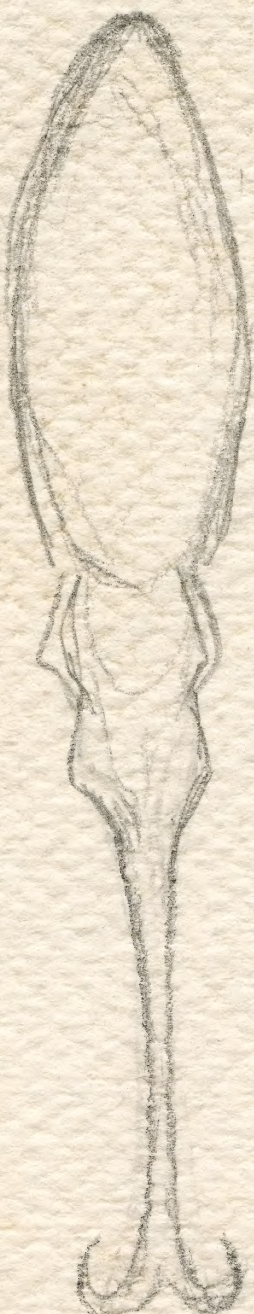
July 23,
1981

Or in colorless
on coral.

July 24, 1981

OO Buffy + Blob

Should be
absolutely
symmetrical



O in Dark

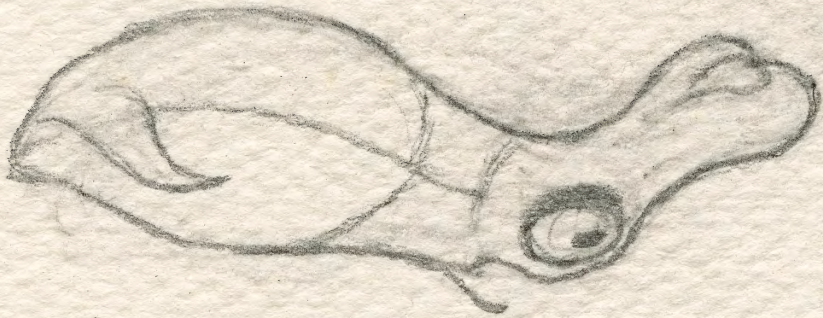
Upward
Curl effect
with Arm stripe



OO
Lophophore

NOTE: Fins may be too large

July 25, 1981



O attached
laterally